UNIVERSITY OF GONDAR

COLLEGE OF MEDICINE AND HEALTH SCIENCES

INSTITUTE OF PUBLIC HEALTH

Willingness to receive short message service mhealth interventions to improve prenatal care among pregnant women attending antenatal care at health centers in Gondar town administration, northwest Ethiopia, 2017.

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Acronym and /or abbreviation

ANC	Antenatal Care
AOR	Adjusted Odd Ratio
AMRH	Amhara Regional Health Bureau
BSC	Bachelor of Science
COR	Crude Odd ratio
EHMIS	Electronic Health Management Information System
EMR	Electronic Medical Record
ETB	Ethiopian Birr
FMOH	Federal Ministry of Health
IDI	Information and communication technology development index
ICT	Information and communication technology
LMIC	Low and Middle Income Countries
MCH	Maternal and Child Health
MDG	Millennium Development Goal
Mhealth	Mobile Health
MPH	Master of Public Health
SDGS	Sustainable Development Goal
SIM	subscriber Identity Module or Subscriber Identification Module
SMS	Short Message Service
SPSS	Statistical Package for Social Science
WHO	World Health Organization

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Abstract

Background: Maternal mortality remains high in many low- and middle-income countries (LMIC) including Ethiopia. Effective communication is vital for the delivery and receipt of sufficient health care services. The rapid growth in mobile phone penetration and use of Short Message Service (SMS) based mhealth interventions is proposed as an effective solution to improve maternal health in LMIC where maternal mortality is higher and limited access to health services is linked to low antenatal care (ANC) utilization. However, there are no published studies reporting data on willingness to receive SMS based mhealth intervention to ANC service among pregnant women in Ethiopian context.

Objective: The aim of this study was to assess willingness to receive SMS based mHealth intervention for ANC service and its associated factors among pregnant women attending ANC at health centers in Gondar Town administration, 2017.

Method: An institution based cross sectional quantitative study was conducted among 416 pregnant women attending ANC from March 27- April 28, 2017. Data were collected using structured interviewer-administered questionnaires. Data entry and analysis were done using Epi-Info version 7 and SPSS version 20 respectively. Descriptive statistics was done. Bivariate and multivariable logistic regression analysis was done. Odds ratio with 95% confidence interval was used to identify the factors associated with the willingness to receive SMS based mHealth intervention.

Results: A total of 416 (98.6 % response rate) responded to complete all the questionnaires. About 76.7% (319/416) of respondents owned a mobile phone, and 71.2% (296/416) were willing to receive SMS. Factors associated with willingness were: Youth age group (AOR = 2.869, 95 % CI: [1.451-5.651], having Secondary or higher education (AOR = 4.995, 95 % CI: [1.489-14.773], put mobile phone in a place where others can access and use (AOR = 0.514, 95 % CI: [0.285-0.929] and holding mobile phone sometimes (AOR = 0.319, 95 % CI: [0.141-0.718]).

Conclusion: A high proportion of respondents have mobile phone and are willing to receive SMS based mhealth intervention. Age, educational status, duration of holding mobile phone and put mobile phone in a place where others could access and use are significantly associated factors to willingness to receive SMS based mHealth intervention.

Keywords: Willingness, SMS, mHealth, Intervention, Pregnant women, Gondar

1. Introduction

1.1 statement of the problem

Maternal health is a critical issue to be addressed worldwide. Every minute of every day, somewhere in the world, women lost their life due to complications related to pregnancy and childbirth, even though the majority of these deaths are preventable by having focused antenatal care service (1, 2). At the completion of the MDG or at the start of the Sustainable Development Goals (SDGs) era, maternal morbidity and mortality related to pregnancy remains unacceptably high(3). Globally every day, about 830 women die from preventable causes related to pregnancy and delivery and about 99% of all maternal deaths occur in developing countries where access to antenatal care services is limited(3). According to EDHS 2016 key indicators report maternal mortality ratio in Ethiopia is 412/100,000(4).

It has been widely stated that routine antenatal care (ANC) visit is one of the most effective ways to reducing maternal morbidity and mortality(5). Despite calls by the world health organization (WHO) for a minimum of four ANC visits, only 32% of pregnant women in Ethiopia attends the recommended antenatal care service(4).

Limited access to health service and lack of effective communication are linked to low antenatal care(6). So new and innovative strategies are required to overcome the problem and improve antenatal care services.

Effective communication is vital for the delivery and receipt of sufficient health care services (7, 8). The field of mobile health (mHealth) has been proposed as a potential solution to many of the challenges that developing countries include Ethiopia face, like health care provider shortages, lack of health information, limited training for health workers, and difficulty tracking pregnant mothers.

The use of mobile telecommunication technology at medical and public health practice is gaining attention because it gives the chances to rapidly connect people, reducing delay across the chain of health decisions, and positively affecting the lives of many of underserved population (9, 10)..

Short message service (SMS) based mhealth intervention for pregnant women improves maternal and child health (11-16). MHealth via short message service (SMS) or text messaging has also been a means of delivering health information and direct health services in the current era (10, 17-19). As it is suggested by mhealth programs implemented in the wired mothers' mobile in Zanzibar (20) and in USA (Text4baby)(13) in which gestational period specific text messages are sent to subscribed women to offer educational material, however the impact of the program is still in evaluation. Lack of evidence is one of the contributing factors for the failure of mhealth programs in Africa(21).

There is not available information in the literature about access to mobile phone and willingness to receive SMS based mhealth intervention for ANC service among pregnant women in Ethiopian context which is the base to develop a strategy using mobile phones for the improvement of ANC. We proposed this study as a crucial initial step to design and implement mHealth interventions in Ethiopia.

1.2 Literature Review

Globally only 64% of pregnant women attends WHO recommended ANC(1). Sub-Saharan Africa is the region with higher mortality ratio and low ANC utilization (2).

A missed appointment is a major cause of inefficiency in healthcare delivery, with substantial financial costs for the health system, leading to delays in diagnosis and appropriate treatment (19). Mobile phones are increasingly used in health care systems in LMICs and considered as innovative technical solutions and have immense potential to defeat barriers of access to antenatal care service (15, 18). SMS based mhealth messaging provides an important role for maternal health care like reminders for healthcare appointments (22).

1.2.1 Access to Mobile phone

A cross sectional survey conducted in southern united states among pregnant women found 88% of the respondent have mobile phone and among these 49% are willing to use SMS based health information via mobile phone(23). A cross sectional study done among pregnant women attending ANC in Argentina indicated that 93.2% of them have mobile phone (22).

Findings from a study done in Timor-Leste shows 67 % of women have access to mobile phone (17). A study conducted in Nigeria among mothers attending a tertiary facility for immunization indicates that 99% of women have mobile phone(24). But a population based survey indicates about 51% of women did not have access (8). Another study conducted in South Africa founds that 84% of pregnant women owned mobile phone (25). A descriptive study in Kenya shows 74.3% of pregnant women owned mobile phone and out of those who did not own a mobile phone 53.4%had shard access to a mobile phone (26).

Educational status, wealth index age and gender are some of the factors associated with mobile phone owner ship (17). Younger women have higher access for mobile technology than aged(27-29). A study conducted in Ethiopia among ART patients shows 76% of them owned mobile phone (30). Mobile (SIM) population in Ethiopia is 48% and When we see the smart phone owner ship of Ethiopia more educated have higher owner ship than less educated (17% and 3%) respectively(27).

1.2.2 Willingness for Short message services mHealth

There are studies conducted to assess the willingness of patients to use mhealth application for appointment reminders, vaccination appointment, general health tips and money others.

A study conducted at two cities in Argentina Mercedes and Rosario, showed that 96% of pregnant women are willing to receive SMS during pregnancy (22). A community based intervention study done in India showed that 70 % of respondents have willingness to respond to short message for maternal and child health (14). Evidences from a study conducted in Nigeria about willingness of mothers towards SMS based service to child immunization shows 77% of the respondents have willingness for the service(24). One study done in South Africa among pregnant women under option B+ to prevent mother-to-child HIV transmission shows 88.1% of respondents are willing to receiving SMS based mhealth application for their ART adherence support messages such as reminders, motivation, and medication updates(31). A study conducted in Kenya indicates among mobile phone owners 92% of pregnant women are willing to receive SMS text message from health care providers(26).

A cross-sectional study done in Ethiopia on Willingness to receive text message medication reminders among patients on antiretroviral treatment shows 50.9% of the respondents were willing (30).

1.2.3 Factors Associated with willingness for SMS based mHealth service

1.2.3.1 *S*ocio-demographic characteristics

There are some studies in the world that revealed willingness for SMS based mhealth application is influenced by socio- demographic factors.

Educational status is significantly associated with willingness for mobile health service; those with higher education are more willing (26, 32-36). It is supported by a study conducted in USA (80 % vs. 62 %; p<0.0001)(37).

A cross sectional study done in Nigeria among women indicates, those with higher educational status are more likely to be willing to receive SMS service for child immunization (OR 2.50, CI 1.41 - 4.42) than less educated(24). Also women with higher health literacy status are more likely willing to use SMS based mobile health application for prenatal service than low health literacy status of women (38).

A cross-sectional study done in Ethiopia on Willingness to receive text message medication reminders among patients on antiretroviral treatment shows having secondary or higher education are more willing(AOR = 4.61, 95% CI: [1.33, 16.01]) than non educated(30).

Age: A cross sectional study conducted in Korea on utilization of mobile health application for prenatal and birth care indicates that younger women are more willing to use SMS based mhealth(39). A study done in United States shows women with old age and having many children are less willing than young age(40).It is supported by another study conducted in Atlanta and southern US (23, 38).A cross sectional study in Kenya also shows variation to willingness for SMS based mhealth application among different age group (33).

Marital status :A descriptive cross-sectional study done in Nigeria shows those who currently married women are7 times (OR 6.81, CI 1.91 - 24.21) willing to use SMS based mhealth application than non married women(24)

Place of residence: Rural women have less access than urban women for mobile phone ownership but it is not true for willingness (41). A study conducted in china among ART patients shows rural residence are more willing to receive SMS (36).

1.2.3.2 Access to health facility and ANC service

As distance increase to health facility the willingness to mhealth is more likely because of transportation access and time to reach to health facility (41, 42).

1.2.4 Pattern of mobile phone Use:

A cross sectional study conducted in United States indicates about 25% of pregnant and post partum women changes their phone numbers 2 or more times in a year(43). A study in India found that among the respondent who had access to mobile phone 100% of them use their phone primarily for receive phone call and only 14% of them for text message. But 99% of them are willing to receive heath information via their phone(44). Another study done in Atlanta shows one fourth (25%) of women changed their mobile phone number within six month and about 7% of the respondents shared a cell phone (38).

The use of mobile phones for medical (m-health) applications in Ethiopia is very low 4.5% set alarm for medical appointments, 8.5% set an alarm for taking medicine, 8.9% obtain SMS reminder from clinic or doctor and 67.4% having mobile contact with health care workers which is lower than Kenya, Uganda ,Nigeria , Rwanda and Ghana(45). But, there is no evidence on pregnant women in Ethiopia.

Network and solar system for charging availability(26), internet access and use(30), are also factors that are associated with access to mobile phone and willingness to use mobile phone for SMS based mhealth(23, 46, 47).

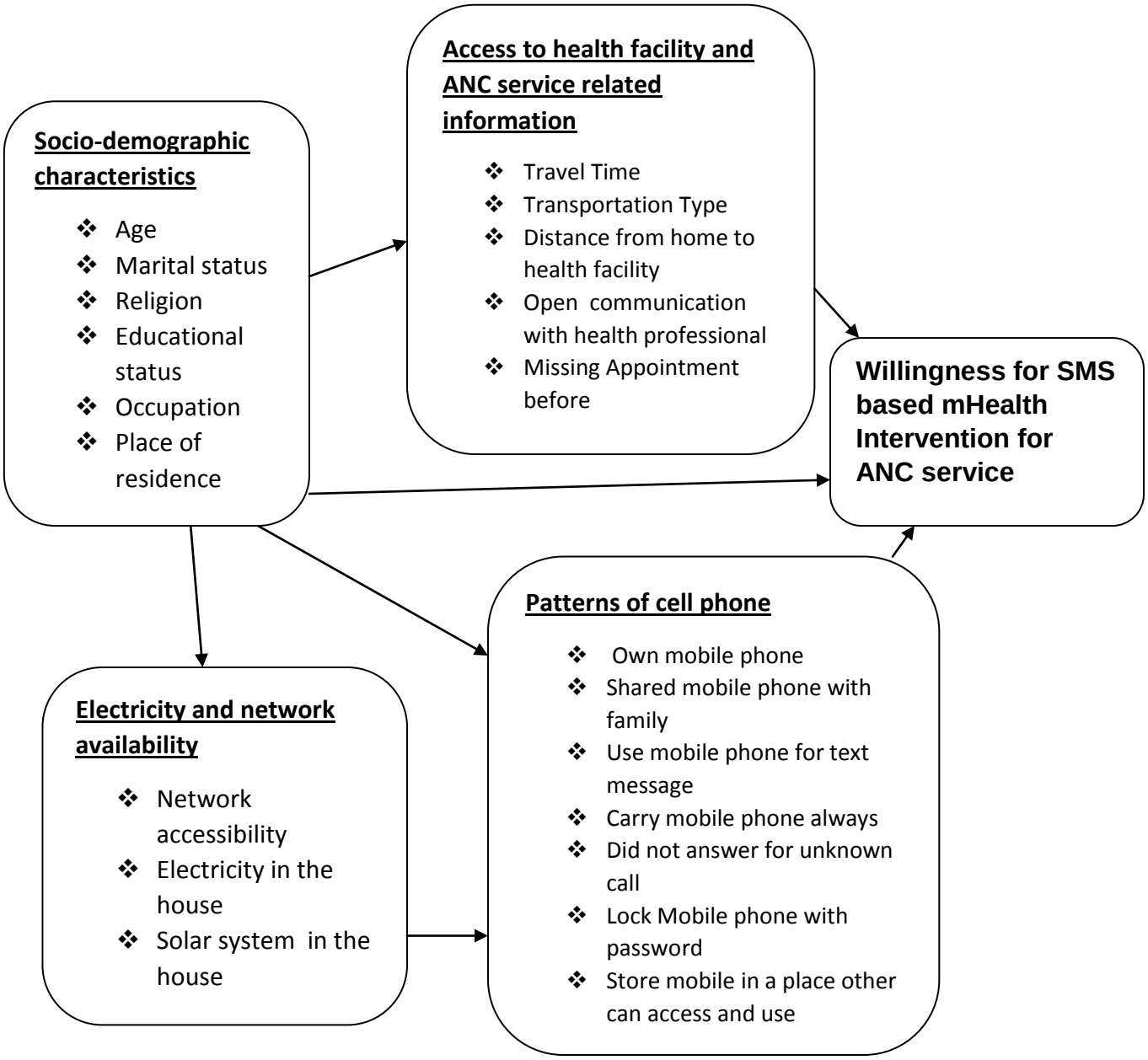

Figure 1: Conceptual Framework for willingness to receive SMS based mhealth intervention among pregnant women attending ANC at health centers in Gondar Town administration, 2017 (Adopted from (23, 24, 26, 30, 32-36, 41-47)).

1.3 Justification of the study

With the aim of reducing maternal mortality, a set of high impact interventions like ANC is being implemented. ANC utilization showed increment in Ethiopia in the last years, however, continuity of service and quality of care is not optimal as evidenced by low coverage of skilled delivery, tetanus toxoid (TT) vaccine uptake, screening for syphilis, and utilization of ITN as well as suboptimal uptake of prevention of mother-to-child transmission of HIV (PMTCT) services by pregnant women. So we need more interventions to reach 95% ANC 4 coverage (HSTP).

For this; mHealth has critical role and understanding the willingness of women to receive SMS is important.

As per the knowledge of the researcher, there is no study in Ethiopian context on willingness of pregnant women to receive SMS based mhealth intervention for antenatal care service. Therefore, this study will fill the gaps in assessing access to mobile phone and willingness to SMS based mobile health intervention for pregnant women attending antenatal care services.

Also this evidence will be vital for different programs and projects from MOH or partner organization, in terms of wise investment on mHealth.

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2. Objectives

2.1. General Objective

- To assess willingness to receive SMS based mHealth intervention to improve prenatal care service and its associated factors among pregnant women attending ANC at health centers in Gondar Town administration, 2017.

Institution based cross sectional study.

2.2. Specific Objectives

- To determine willingness to receive SMS based mHealth intervention to improve prenatal care among pregnant women attending ANC at health centers in Gondar Town administration, 2017.
- To identify factors associated with willingness to receive SMS based mHealth intervention to improve prenatal care among pregnant women attending ANC at health centers in Gondar Town administration, 2017.

3. Methods

3.1 Study design

Institution based cross-sectional study was conducted.

3.2 Study area and period

This study was conducted from March 27- April 28, 2017 at health centers in Gondar Town Administration of Amhara Region (Figure 2). Gondar is located 738km from Addis Ababa (the capital city of Ethiopia) and 168km from Bahir Dar (capital city of Amhara regional state).

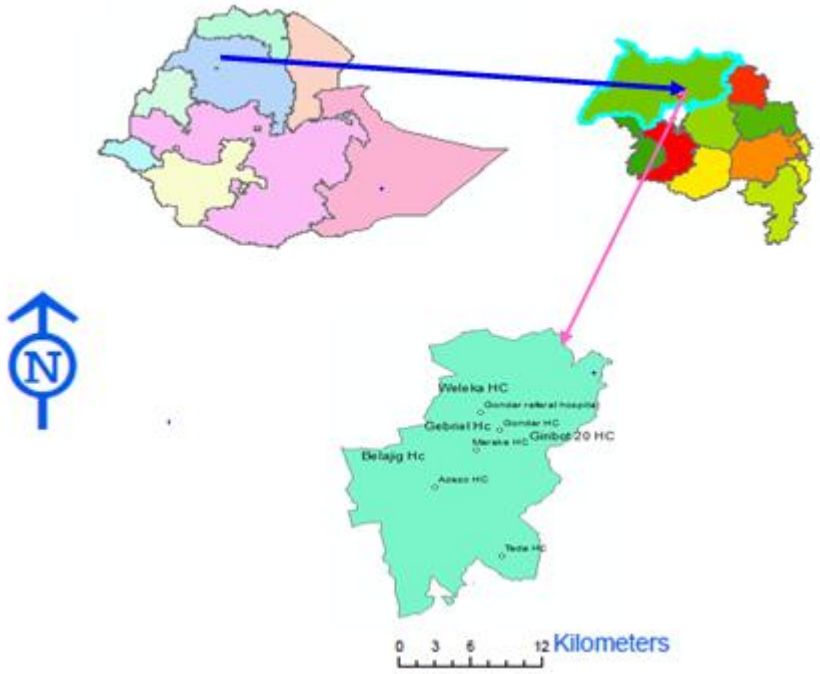

Figure 2: Map of study area

Gondar town Administration divided in to 8 clusters namely Gondar, Ginbot 20, Azezo, Gebriel, Maraki, Woleka, Teda and Belajig. The administration has a total of 24 Kebele 13 urban and 11 rural. In the administration there are a total of 23 public health facilities 1 Referral hospital 8 health centers and 14 health posts. Also there are 47 private health facilities 1 General Hospital, 10 specialty clinic,4 higher clinic, 14 medium clinic and 18 other category all of them can provide ANC service. An estimated population is 327,661 of which 162,192 (49.5%) of them are female; 165,469 (50.5%) are male. Among the total population 260183 are urban inhabitants and the rest 67,478 are rural inhabitant. The number of women in reproductive age group is 77,262 and the estimated number of

pregnancy is 11042 in 2016/2017 budget year (data from Gondar Town health department).

3.3 Source and study population

3.3.1 Source population

All pregnant women attending ANC service at health centers in Gondar town administration.

3.3.2 Study population

All women who were pregnant and attending ANC service at health centers during the study period were used as a study population.

3.4 Inclusion and Exclusion Criteria

3.4.1 Inclusion criteria

All pregnant women attending ANC service at health centers during the study period.

3.4.2 Exclusion Criteria

All pregnant women attending ANC service at health centers and who can't hear and see.

3.5 Sample size determinations and sampling procedures

3.5.1 Sample Size Determination

The sample size of this study was determined using single population proportion formula:

$$n = \frac{(Z^{\alpha}/_{2})^2 x\ p(1-P)}{d^2}$$

With the following assumptions:

n = the required sample size

Z = the value of standard normal distribution corresponding to α/2= 1.96

p = proportion of pregnant women who are attending ANC and willing to be contacted by mobile phone

q = 1-p, proportion of pregnant women who are attending ANC and not willing to be contacted by mobile phone

d=is the margin of error 5% (0.05),

But, we could not find any study conducted to determine the access to mobile among pregnant women who are attending ANC, however, the general population's access to mobile phone in Ethiopia is 48%(27) . As we also could not found any study conducted in Ethiopia to determine the willingness of pregnant women who are attending ANC to receive SMS text message for ANC services. Therefore by assuming a proportion (p) of 50% of pregnant women willing to receive SMS based mhealth intervention for ANC services.

$$n = \frac{(Z^{\alpha}/_{2})^2 x\, p(1-P)}{d^2},\ n = \frac{(1.96)^2 x\, 0.5(1-0.5)}{(0.05)^2} = 384$$

With those numbers two sample sizes was calculated. The maximum sample size is 384 using the proportion of pregnant women who are attending ANC and willing to be contacted by mobile phone.

With 10% non-response rate the final sample size will be (384) x0.1+384=422.4=**422**

3.5.2 Sampling Procedure

There are 8 health centers in the administration. From each health center the numbers of pregnant women attending ANC during the study period was included in the study by their proportion based on their actual number of women attend ANC in the last year with similar month with data collection period. Then, each pregnant woman from each health center was selected by systematic sampling technique (k=2).

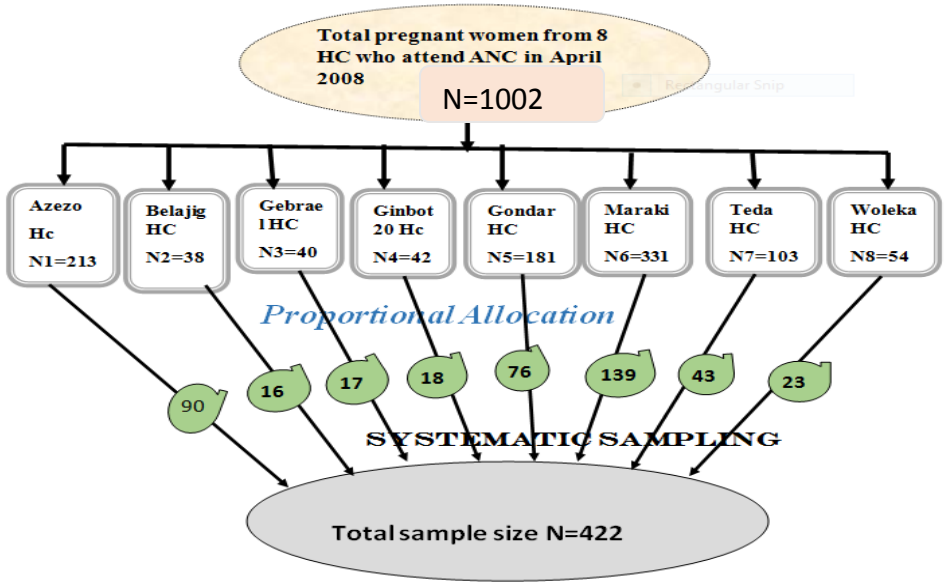

Figure 3: schematic presentation of sampling procedure

3.6 Study Variables

3.6.1 Dependent variable

Willingness for SMS based mHealth intervention for ANC service (Yes or No)

3.6.2 Independent variables

- **Socio-demographic factors**
- Age, Educational status, religion, residence, occupation, marital status, number of children
- **Accessibility to health facility and ANC service related information**
    - Travel Time
    - Transportation Type
    - Distance from home to health facility
    - Heard ANC related information before
    - Number of ANC
    - Open communication with health professional
    - Missing Appointment before
- **Electricity and network availability**
    - Network availability
    - Electricity in the house
    - Solar system in the house
- **Patterns of cell phone**
    - Have Own mobile phone
    - Mobile phone type
    - Share mobile phone to others
    - Use mobile phone for text message
    - Duration of holding mobile phone
    - Did not answer for unknown call
    - Lock mobile phone with password
    - put mobile phone where can access and use

3.7 Operational definition

Access to mobile phone:-Those pregnant women who owned mobile phone currently and/or have shared mobile phone with family members in the house hold.

Willingness:-Those pregnant women who have interest to use their mobile phone to get ANC service related health information via SMS.

MHealth:- it is the provision of health service and intervention via mobile phone.

Smart phone:-Type of mobile phone with multiple functions and the operating systems are android, iOS, BlackBerry and Windows.

SMS: is a system that enables mobile phone users to send and receive text messages up to 160 characters.

Standard mobile phone: - Type of mobile phone with basic functions like phone call and text messaging and limited internet connection.

3.8 Data Collection Tools, Procedures and Data Quality Control

3.7.1 Data collection tools

The structured questionnaires used for this study was adopted and modified from different reviewed literatures.

The questionnaire comprised socio-demographic characteristics, physical accessibility to health facility, Electricity and network availability, patterns of mobile phone use and women's Willingness to receive health information via SMS by mobile phone.

Questionnaires was first developed in English and then underwent forward and backward translation to ensure semantic consistency (English to Amharic then English), for appropriateness and easiness in approaching the study participants.

3.8.2 Data collection Procedures

Exit interview was conducted to collect individual information using a pretested and structured interviewer administered questionnaire and it was conducted in a private place to ensure confidentiality and reduce information bias. To do this, 2 HIT and 2 BSC nurse as supervisor and 8 clinical nurse graduates from health science colleges as field data collector were recruited and involved for the data collection process. The questionnaire comprised socio-demographic characteristics, physical accessibility to health facility, Electricity and network availability, patterns of mobile phone use and women's Willingness to receive health information via SMS by mobile phone.

3.8.3 Data Quality Control

One day training was given for data collectors and supervisors on research ethics, providing informed consent, data collection procedures, data collecting tools, how to

approach participants, data confidentiality, respondent's right and all the study protocols to be followed throughout the course of the data collection period. Continuous monitoring by supervisors was done throughout data collection period to ensure that the data is collected according to the study protocol.

Before the actual data collection, pretesting of the questionnaire was conducted among pregnant women attending ANC (5% of the sample) before the study period at health centers in Debre-tabor town administration and then necessary modifications were taken based on the pretest findings.

3.8.4 Data Processing and Analysis

Data from respondents was edited and cleaned manually before entered in to the computer. Data entry template was created based on study variables on Epi info version 7 and manually edited data was entered to the software for further editing and exported to Statistical Package for Social Science (SPSS) version 20 for further analysis. Descriptive Frequencies, means, and standard deviations were summarized to describe the study population in relation to relevant variables by using SPSS. These were presented in tables and texts.

. The binary logistic regression using enter method was used to analyze the association between individually the independent variable to the dependent variable (willingness for SMS based mhealth). The dependent variable was designated as (''no'=0 have no willingness and yes'=1 for having willingness).

By showing unadjusted OR, variables which had an association with the dependent variable and p-value less than 0.2 in bivariate analysis was entered into multivariable analysis using enter method for controlling the possible effects of confounders. In the multivariate analysis, Hosmer and Lemeshow goodness of fit test was performed and variables which were significant on the bases of adjusted Odds Ratio (AOR), with 95%CI and p-value <0.05 considered to be the determinant factors of willingness to receive SMS mHealth intervention.

4. Ethical Consideration

Ethical clearance was obtained from the ethical review board of University of Gondar. Communication with the different official administrators was made through formal letter obtained from the University of Gondar. Supporting letter was also obtained from Gondar town health department. Oral consent was obtained from the study participants after telling the objective of the study. They were also informed about the benefits of the study. If they feel discomfort on the interview they were informed that they can stop at any time. In order to keep confidentiality assurance to the study participants was provided on any information provide by them. The data collection procedure was anonymous and their privacy was kept.

5. Result

5.1 Socio demographic characteristics of Respondents

A total of 422 pregnant women from 8 public health centers were approached, 416 of them verbally consented and responded to complete all the questionnaires at health center with 98.6% response rate. From the total (n=416) respondents 338(81.3%) were urban residence. The age of the respondents ranged from18-45 years with a mean 26.6±5.387 years (SD=5.387). Majority of them were married 393(94.5%) and orthodox Christians 347(83.4%). Two hundred eighty (67.3%) were house wives and 215(51.7%) of respondents had at least secondary education.

Table 1Socio-demographic characteristics of pregnant women attending ANC follow up at health centers in Gondar town administration Northwest Ethiopia, 2017.

Socio-demographic characteristics		Number	Percent
Age	15-24	160	38.5
	≥25	256	61.5
Residence	Urban	338	81.3
	Rural	78	18.7
Religion	Orthodox	347	83.4
	Muslim	64	15.4
	*Other[1]	5	1.2
Marital status	Not married	14	3.4
	Married	393	94.5
	*Other[2]	9	2.2
Educational status	Can't read and write	70	16.8
	Can read and write	21	5
	Primary	110	26.4
	Secondary and above	215	51.7
Occupation	House wife	280	67.3
	Civil servant	49	11.8
	Merchant	48	11.5
	Daily laborer	24	5.8
	Student	12	2.9
	*Other[3]	3	0.7
Whom do you Live with	With Family	385	92.5
	Lonely	24	5.8
	*Other[4]	7	1.7
Number of children	No child	185	44.5
	One	77	18.5
	Two	80	19.2
	Three	44	10.6
	Four and more	30	7.2

***Other[1]=Protestant, catholic Judith, *Other[2]=separated, windowed and died, *Other[3]=Farmer, driver, Jobles, *Other[4]=Parents**

5.2 Mobile phone ownership by socio-demographic characteristics

Mobile phone ownership varied across different socio -demographic variables. Among 256 respondents whose age ≥25 years, 201(78.5%) had mobile phone which is higher than the respondents whose age were 15-24 years 73.8%. Ownership to mobile phone was very high among urban residence as compared to rural residence (88.2%vs26.9%)(Table2).

Table 2: Mobile phone ownership by socio-demographic characteristic of pregnant women attending ANC follow up at health centers, Gondar town administration Northwest Ethiopia, 2017.

Socio-demographic Characteristics		Have mobile phone(n=416)	
		Yes	No
		No (%)	No (%)
Age	15-24	118(73.8)	42(26.2)
	≥25	201(78.5)	55(21.5)
Residence	Urban	298(88.2)	40(11.8)
	Rural	21(26.9)	57(73.1)
Religion	Orthodox	255(73.5)	92(26.5)
	Muslim	59(92.2)	5(7.8)
	*Other[1]	5(100)	0
Marital status	Not married	10(71.4)	4(28.6)
	Married	303(77.1)	90(22.9)
	*Other[2]	6(66.7)	13(33.3)
Educational status	Can't read and write	21(30)	49(70)
	Can read and write	12(57.1)	9(42.9)
	Primary	85(77.3)	25(22.7)
	Secondary and above	201(93.5)	14(6.5)
Occupation	House wife	192(68.6)	88(31.4)
	Civil servant	49(100)	0
	Merchant	46(95.8)	2(4.2)
	Daily laborer	20(83.3)	4(16.7)
	Student	10(83.3)	2(16.7)
	*Other[3]	2(2(66.7)	1(33.3)
Whom do you Live with	With Family	294(76.4)	91(23.6)
	Lonely	21(87.5)	3(12.5)
	*Other[4]	4(57.1)	3(49.2)
Number of children	No child	160(86.5)	25(13.5)
	One	59(76.6)	18(23.4)
	Two	60(75)	20(25)
	Three	29(65.9)	15(34.1)
	Four and more	11(36.7)	19(63.3)

***Other[1]=Protestant, catholic Judith, *Other[2]=separated, windowed and died, *Other[3]=Farmer, driver, Jobles, *Other[4]=Parents,**

5.3 Willingness by socio-demographic variables

Respondents in the youth age group were more willing than adults (83.1%vs63.7%).

Three fourth of urban residence were willing to receive SMS based mhealth intervention which is higher than rural residence (75.4%vs52.6%). Among respondents who had secondary and above educational level, 171(79.5%) of them were willing to receive SMS based mhealth intervention (Table 3).

Table 3: Willingness of pregnant women to receive SMS based mhealth intervention by socio-demographic variables at health centers in Gondar town administration Northwest Ethiopia, 2017.

Socio-demographic Characteristics		Pre. women(n=416) Number	percent	Willing to receive SMS Yes	No
				No (%)	No (%)
Age	15-24	160	38.5	133(83.1)	27(16.9)
	≥25	256	61.5	163(63.7)	93(36.3)
Residence	Urban	338	81.3	255(75.4)	83(24.6)
	Rural	78	18.7	41(52.6)	37(47.6)
Religion	Orthodox	347	83.4	247(71.2)	100(28.8)
	Muslim	64	15.4	46(71.8)	18(28.1)
	*Other[1]	5	1.2	3(60)	2(40)
Marital status	Not married	14	3.4	10(71.4)	4(28.6)
	Married	393	94.5	279(71)	114(29)
	*Other[2]	9	2.2	7(77.7)	2(22.2)
Educational status	Can't read and write	70	21.9	34(48.6)	36(51.4)
	Can read and write	21		13(61.9)	8(38.1)
	Primary	110	26.4	78(70.9)	32(29.1)
	Secondary and above	215	51.7	171(79.5)	44(20.5)
Occupation	House wife	280	67.3	190(67.8)	90(32.1)
	Civil servant	49	11.8	43(87.8)	6(12.2)
	Merchant	48	11.5	30(62.5)	18(37.5)
	Daily laborer	24	5.8	20(83.3)	4(16.7)
	Student	12	2.9	11(91.7)	1(8.3)
	*Other[3]	3	0.7	2(66.7)	1(33.3)
Whom do you Live with	With Family	385	92.5	271(70.3)	4(16.7)
	Lonely	24	5.8	20(83.3)	114(29.6)
	*Other[4]	7	1.7	5(71.4)	2(28.6)
Number of children	No child	185	44.5	169(91.4)	16(8.6)
	One	77	18.5	56(72.7)	21(27.3)
	Two	80	19.2	50(62.5)	30(37.5)
	Three	44	10.6	17(38.6)	27(61.4)
	Four and more	30	7.2	4(13.3)	26(86.7)

***Other[1]=Protestant, catholic Judith, *Other[2]=separated, windowed and died, *Other[3]=Farmer, driver, Jobless, *Other[4]=Parents,**

5.3 Access to electricity and network

Majority of the respondents 343(82.5%) had electricity in their house and almost all, 414(99.5%) had network access in their house and around.

5.4 Accessibility to health facility and ANC service related information

Among the respondents 110(26.4%) of them came for first ANC follow up and only 41(9.9%) were for ANC4 follow up. Overall the mean travel time to get the health center was 19.89 minute and majority, 336(80.8%) said it takes less than 30 minute to reach the nearby health center and only 5(1.2%) respondents reported it takes two hours.

But about 190(45.7%) of study subjects described that the health center is far from their home.

The vast majority of respondents 400(96.2%) heard information about ANC service before. About 374(89.9%) heard the information from health facility, 219(52.6%) from HEW, 212(51%) from radio/TV, 100(24%) from relatives and 40(9.6%) from short text message. All of the respondents described that they had open communication about their pregnancy status.

The Majority, 410(98.6%) of respondent got appointment date for next follow up and 390(95.1%) of them agreed with the given appointment date. One hundred five (34.3%) missed there appointment date for the current pregnancy and the main reasons to miss appointment date was forgetfulness 61% (64/105) followed by being busy 26.6 %(28/105). About sixty two percent (189/306) of respondents described that they use their appointment card to remember the next appointment date.

5.5 Willingness to receive SMS based mhealth intervention by accessibility to health facility and ANC service related information

Among the respondents who described the health center is not distant the majority 178(78.8%) were willing which is higher than those who said distant (62.1). Way of transportation on foot and car/Bajaj did not show more discrepancy for willingness (71.8%vs71.4%).

Women who heard any information about ANC before were less willing to receive SMS than who didn't hear before. But willingness varied across source of information they heard about ANC. Those heard information about ANC from text message were more willing than others. The willingness among respondents who missed and didn't miss their appointment for current pregnancy was nearly similar (70.5%vs71.1%).

Table 4: Willingness of pregnant women to receive SMS based mhealth intervention by accessibility to health facility and ANC service related information in Gondar town administration, 2017.

Variables	Pregnant women	Willingness to receive SMS	
		Yes	No
	No (%)	No (%)	No (%)
Distance to health facility			
Not distant	226(54.3)	178(78.8)	48(21.2)
Distant	190(45.7)	118(62.1)	72(37.9)
Time took to reach health facility			
Less than 30	336(80.8)	253(75.3)	83(24.7)
30-59	49(11.8)	29(59.2)	20(40.8)
60-119	26(6.3)	11(42.3)	15(57.7)
120 and above	5(1.2)	3(60.0)	2(40)
Way of Transportation			
On foot	238(57.2)	171(71.8)	67(28.2)
By car/Bajaj	175(42.1)	125(71.4)	50(28.6)
Animal	3(0.7)	0	3(100)
Hear any information about ANC before			
Yes	400(96.2)	284(71)	116(29)
No	16(3.8)	12(75)	4(25)
Heard information from Health facility			
Yes	374(89.9)	268(71.7)	106(28.3)
No	42(10.1)	28(66.7)	14(33.3)
Heard information from radio/TV			
Yes	212(51)	161(75.9)	51(24.1)
No	204(49)	135(66.2)	69(33.8)
Heard information from HEW			
Yes	219(52.6)	148(67.6)	71(32.4)
No	197(47.4)	148(75.1)	49(24.9)
Heard information from text message			
Yes	40(9.6)	32(80)	8(20)
No	376(90.4)	264(70.2)	112(29.8)
Heard information from relatives			
Yes	100(24)	77(77)	23(23)
No	316(76)	219(69.3)	97(30.7)
Get appointment for next visit			
Yes	410(98.6)	(291(71)	119(29)
No	6(1.4)	5(83.3)	1(16.7)
Agree with appointment date (n=410)			
Yes	390(95.1)	277(71)	113(29)
No	20(4.9)	14(70)	6(30)

Missed your appointment before(n=306)			
Yes	105(34.3)	74(70.5))	31(29.5)
No	201(65.7)	(143(71.1)	58(28.9)
Reason to miss appointment date(n=105)			
I forgot	64(61)	47(73.4)	17(26.6)
I was busy	28(26.6)	20(71.4)	8(28.6)
*Other[1]	13(12.4)	7(53.8)	6(46.2)
Mechanism used to remember appointment date (n=306)			
Telling to family	101(33)	60(59.4)	41(40.6)
Using appointment card	189(61.8)	144(76.2)	45(23.8)
Telling to neighbour	11(3.6)	8(72.7)	3(27.3)
*Other[2]	5(1.6)	5(100)	0

Other[1]=It is too far, I didn't have money, I didn't get permission from employed, I was sick, mixed up dateOther[2]=**calling to health facility, Alarming**

5.6 Mobile phone ownership and patterns of mobile phone use

About 88.5% of women reported that having at least one mobile phone in the family. Among the respondents 343 (82.5%) had ever owned a mobile phone, while 319(76.7%) were current owners and 271 (85%) have had the same phone number for more than a year. One hundred twenty (37.6) of current mobile phone owners had smart phone. The main reason not to have mobile phone currently were, can't afford to buy 54.6% (53/97) followed by mobile phone broken 17.5 %(17/97). Among current mobile phone owners, 229(71.8%) of them used their mobile phone to send text message before.

.From those pregnant women who currently owned a mobile phone only 106(33.2%) were use their mobile phone for health related information or purpose and from which 53(50%) were setting alarm to take medication, 39(36.85) received health related SMS/call from health organization or health care providers, 34(32.1%) to consult health professionals and 26(24.5%) to browse health related information using internet.

The majority, 286(89.7%) of women described that they always hold their mobile phone. About 48(15%) of the respondents changed their mobile phone number in the last one year. About one third of women, 100(31.3%) said that there is a time or place where calls are not answered and 47(14.7%) were switch of mobile phone during the day time.

About 164(51.4%) of the respondents lock their mobile phone with a password and 96 (30.1 %) of the women put their mobile phone in a place where others can see and

access it easily. Among mobile phone owners 94(29.8%) of them described that they share their mobile phone with others in house with family members.

The vast majority 287(90%) of respondents described that they able to read and 277(86.8%) able to send text messages using their mobile phone. But 18(6.3%) of them described that they delete text message without read it. From current mobile phone owners, 151(47.3%) of pregnant women described that they access internet by using their mobile phone. From those pregnant women who are using internet on their mobile phone, 143(94.7%) reported that they are Facebook users to chat with friends and relatives.

5.7 Willingness to receive SMS based mhealth intervention by Patterns of mobile use

As shown from (table 5) among pregnant women currently owned mobile phone, willingness to receive SMS varied across patterns of mobile phone usage. Those who owned Smartphone were more willing than those owned standard type of mobile phone (84.2%vs72.4%). willingness to receive SMS among respondents who used and not used mobile phone to send text message before greatly varied(80.3%vs67.8%).

There was discrepancy for willingness to receive SMS among pregnant women who used and not used their mobile for health related information. Those who setting alarm to take medication are more willing than those who didn't use before (85%vs75.2%), received SMS from health organization before was more willing than not received (79.5%vs76.4%), but the willingness to receive SMS among respondents who browse and not browse internet and consult health professionals and didn't consult was almost similar (77%vs76.8%) and (76.5%vs77%) respectively.

The majority of women, 229(80.1%) who hold their mobile phone always were more willing to receive SMS than those who hold their mobile phone sometimes 16(48.5%). The willingness to receive SMS was higher among respondents who locked their mobile phone with password than who didn't lock their mobile phone with password (80.5%vs 72.9%).Those who described that put mobile phone in a place where others could use and access were less willing to receive SMS. Internet users via their mobile phone were more willing than non users (82.1%vs72%).

Table 5: Willingness to receive SMS based mhealth intervention by patterns of mobile phone use among pregnant women attending ANC follow up at health centers in Gondar town administration Northwest Ethiopia ,2017(n=319)

Patterns of mobile phone use			Willingness to receive SMS	
			Yes	No
		No (%)	No (%)	No (%)
Mobile phone type	Smart	120(37.6)	101(84.2)	19(15.8)
	Standard	199(62.4)	144(72.4)	55(27.6)
sent text message text message	Yes	229(71.8)	184 (80.3)	45(19.7)
via mobile phone before	No	90(28.2)	61(67.8)	29(32.2)
Use mobile phone for health	Yes	106(33.2)	85(80.2)	21(19.8)
information before	No	213(66.8)	160(75.1)	53(24.9)
Setting alarm for taking medication	Yes	53(16.6)	45(85)	8(15)
	No	266(83.4)	200(75.2)	66(24.8)
Received SMS from health	Yes	39(12.2)	31(79.5)	8(19.5)
organization before	No	280(87.8)	214(76.4)	66(23.6)
Consult health professionals	Yes	34(10.7)	26(76.5)	8(23.5)
	No	285(89.3)	219(77)	66(23)
Use internet to browse health	Yes	26(8.2)	20(77)	6(23)
related data	No	293(91.9)	225(76.8)	68(23.8)
Hold mobile phone	Always	286(89.6)	229(80.1)	57(19.9)
	Sometimes	33(10.3)	16(48.5)	17(51.5)
Changed your SIM card in the last	Yes	48(15)	35(72.9)	13(27.1)
12 months	No	271(85)	210(77.5)	61(22.5)
Have additional SIM card	Yes	22(6.9)	20(90.9)	2(9.1)
	No	297(93.1)	225(75.8)	72(24.2)
Switch off your mobile phone during	Yes	47(14.7)	34(72.3)	13(27.7)
day time	No	272(85.3)	211(77.6)	61(22.4)
There are times or places calls are	Yes	108(33.9)	82(75.9)	26(24.1)
not answered	No	211(66.1)	163(77.5)	48(22.7)
There are times, places or	Yes	100(31.3)	75(75)	25(25)
situations that unknown calls are	No	219(68.7)	170(77.6)	49(22.4)

unanswered				
Locked mobile phone with	Yes	164(51.4)	132(80.5)	32(19.5)
password	No	155(48.9)	113(72.9)	42(27.1)
put mobile phone where others	Yes	96(30.1)	63(65.6)	33(34.4)
could use and access	No	22369.9)	182(81.6)	41(18.4)
Share mobile phone with others in	Yes	95(29.8)	64(67.4)	31(32.4)
the house	No	224(70.2)	181(80.8)	43(19.2)
Can send text message	Yes	277(86.8)	219(79.1)	59(209)
	No	42(13.2)	26(61.9)	16(38.1)
Can read text message	Yes	287(90)	226(78.7)	61(21.3)
	No	32(10)	19(59.4)	13(40.6)
Deleted text message without	Yes	18(6.3)	17(94.4)	1(5.6)
reading	No	269(93.7)	211(78.4)	58(21.6)
Likelihood of text message to be	Very likely	26(8.1)	17(65.4)	9(34.6)
seen by others	likely	57(17.9)	38(66.7)	19(33.3)
	Unlikely	71(22.3)	55(77.5)	16(22.3)
	Very unlikely	165(51.7)	135(81.8)	30(18.2)
Use internet via your mobile phone	Yes	151(47.3)	124(82.1)	27(17.9)
	No	168(52.7)	121(72)	47(28)
chatting with friend and relatives	Yes	143(94.7)	123(86)	20(14)
	No	8(5.3)	1(12.5)	7(87.5)
Email	Yes	88(58.3)	77(87.5)	11(12.5)
	No	63(41.7)	47(74.6)	16(25.4)
To browse information	Yes	46(30.5)	39(84.8)	7(15.2)
	No	105(69.5)	85(81)	20(19))
For entertainment	Yes	48(31.8)	42(87.5)	6(12.5)
	No	103(68.2)	82(79.6)	21(20.4)

5.8 Attitude and Willingness to receive SMS mhealth interventions

Two hundred and ninety six (71.2%) of respondents were willing to receive short message service with information regarding antenatal care (Table 6). The time at which they would want to begin receiving text messages varied greatly (from 1 month 117(39.5%), from 3 month of pregnancy 163(55.1%), 6 month of pregnancy 10(3.4%) and at nine month of pregnancy but before delivery 6(2%).

The time at which they would want to receiving text messages varied greatly. Fifty nine (19.9%) of women preferred to receive text message at morning (8 am-before 12 pm), 20(6.8%) in the afternoon (12 pm-before 4 pm), 38(12.8%) evening (4 pm-before 8 pm), and majority 179(60.5%) of them described they can receive at any time of the day.

Among respondents who were willing to receive SMS more than three fourth of them prefer to receive text messages with a frequency of once a week.

Overall, women were interested to receive pregnancy and related information via SMS. Among pregnant women who had willingness to receive SMS about 285(96.3%) were willing to receive information regarding to activities/things to be avoid during pregnancy.

Those who intend to receive health information regarding to delivery courses via SMS were 268(90.5%). Respondents were also willing to receive SMS about; what to expect at various stages of pregnancy 249(84.1%), prenatal dietary information 236(79.7%), Appointment reminders 209(70.6%), when to call a doctor during pregnancy 107(36.1%) and physical activities during pregnancy 88(29.7%)

Among the respondents who had willingness to receive SMS the majority, 232(78.4) indicated that they are willing to pay for the service based on the current tele tariff.

Table 6: Attitude and Willingness to receive SMS mhealth interventions among pregnant women attending ANC follow up at health centers in Gondar town administration Northwest Ethiopia, 2017

Text message		Pregnant women	
		Number	percent
Willing to receive SMS(n=416)	Yes	296	71.2
	No	120	28.8
Reason not to be willing	Ruins privacy	50	41.7
	Text message is annoying	2	1.6
	Difficult to operate	54	45
	Not important	14	11.7
Preferred time to begin receiving SMS(n=296)	Before 1month	117	39.5
	From 3 month	163	55.1
	From 6 month	10	3.4
	From 9 month(before birth	6	2
Preferred time of the day for receiving SMS(n=296)	Morning(8am-before 12pm)	59	19.9
	Afternoon(12pm-before 4pm)	20	6.8
	Evening(4pm-before 8pm)	38	12.8
	Any time	179	60.5
Preferred frequency(n=296)	1 per week	223	75.3
	3 per week	70	23.6
	5 per week	2	0.7
	7 per week	1	0.3
Will pay for the service(n=296)	Yes	232	78.4
	No	64	21.6
Preferred pregnancy information to receive			
Activities/things to avoid(n=296)	Yes	285	96.3
	No	11	3.7
When to call a doctor(n=296)	Yes	107	36.1
	No	189	63.9
Diet	Yes	236	79.7
	No	60	20.3
Appointment reminders(n=296)	Yes	209	70.6
	No	87	29.4
What to expect at various stages of pregnancy(n=296)	Yes	249	84.1
	No	47	15.9
Physical activity(n=296)	Yes	88	29.7
	No	208	70.3
Pregnancy & delivery courses(n=296)	Yes	268	90.5
	No	28	9.5

5.9 Logistic Regression Analysis for associated factors

5.9.1 Factors associated with willingness to receive short message service

Bivariable and multivariable logistic regression analysis of possible explanatory variables of willingness to receive short message service was carried out on socio-demographic and other characteristic through checking of the model goodness of fittest.

Variables in the bivariate analysis of socio-demographic, patterns of mobile phone use ,access to health facility and ANC related information factors with respect to willingness to receive SMS; which were found at p-value <0.20 were further considered in to multivariable analysis model using enter method (Table 7).

The multivariable logistic regression analysis revealed that the following factors were significantly associated with willingness to receive SMS based mhealth intervention among pregnant women: youth age group (15–24 years; p = 0.002), educational status (primary; p=0.040, Secondary and above; p = 0.004); did not put mobile in a place where others access and use (p = 0.028), hold mobile phone always (p = 0.006) (Table 7).

Respondents in the youth age group were 2.87 times (AOR=2.869,95% CI:1.451-5.651) more likely willing to receive short message service mhealth interventions than those who were greater than 25 years of age.

Respondents with secondary and higher educational level were 5 times (AOR= 4.995, 95% CI: 1.689-14.773) more likely to receive SMS than pregnant women who didn't have formal education.

Women's willingness to receive text message also strongly associated with place where they put their mobile phone. Those respondents who put their mobile in a place where others could access and use were 48.6% (AOR=0.514, 95% CI: 0.285-0.929) less likely to be willing to receive short message service mhealth intervention than those who didn't put their mobile phone in a place where others can access and use. Those respondents who hold their mobile phone some times were 68.1% (AOR=0.319, 95% CI: 0.141-0.718) less likely to be willing than those who hold always.

Table 7: Bivariate and multivariable analysis of factors with willingness to receive SMS based mhealth interventions to improve ANC among pregnant women attending ANC at health centers in Gondar town administration North West Ethiopia(n=416)

Factors	Willingness		COR(95% CI	AOR(95% CI)
	Yes	No		
Age				
15-24	133	27	2.810(1.729-4.569)	**2.869(1.451-5.651)****
≥25	163	93	1	1
Place of residence				
Urban	255	83	2.773(1.667-4.612)	
Rural	41	37	1	
Educational level				
Can't read and write	34	36	1	1
Can read and write	13	8	1.721(0.634-4.666)	5.032(0.792-31.978)
Primary	78	32	2.581(1.383-4.815)	**3.040(1.001-9.230)****
Secondary and above	171	44	4.115(2.318-7.305)	**4.995(1.489-14.773)****
Get ANC information from radio/TV				
Yes	161	51	1.614(1.052-2.470)	
No	135	69	1	
*Type of mobile phone				
Smart	101	19	2.030(1.136-3.627)	
Standard	144	55	1	
* Holding mobile phone				
Always	229	57	1	1
Some times	16	17	0.234(0.112-0.492)	**0.319(0.141-0.718) ****
*Lock mobile phone with password				
Yes	132	32	0.110(0.652-1.102)	
No	113	42	1	
*Put mobile phone where others could use and access				
Yes	63	33	0.430(0.250-0.738)	**0.514(0.285-0.929) ****
No	182	41	1	1
Share mobile phone with others in the house				
Yes	64	31	1	
No	181	43	2.039(1.181-3.508)	
* Use internet				
Yes	124	27	1.784(1.044-3.047)	
No	121	47	1	1

N**.B: variables with * indicates n=319 or mobile phone ownership,**

**** statistically significant at p-value < 0.05**, **1=reference**

6. Discussion

This result shows that access to mobile phone among pregnant women attending antenatal care at health centers in Gondar town administration was high. About 88.5% of women reported that having at least one mobile phone in the family. More than three quarter, 76.7% (95% CI: 72.8-80.8%) of women owned mobile phone during the study period. The study also shows that about 71.2 % (95 % CI: 66.8-75.5 %) of pregnant women were willing to receive short message text message mhealth interventions for antenatal care services. This finding is important, especially as one of the reasons given for missing ANC visit appointments was mothers forgot the appointment date.

Age, educational level, duration of holding mobile phone, put mobile phone in a place where others could access and use are among the notable factors associated with willingness of pregnant women to receive SMS based mhealth interventions.

Mobile phone ownership of women in this study (76.7 %) is lower than studies from USA 88%(23), Argentina 93.2%(22) and South Africa 84%(25). This discrepancy might be due to the difference in information and communication technology (ICT) infrastructure and socioeconomic status among the countries. This is also lower than studies done in Nigeria among women attending tertiary facility for childhood immunization (99%). This disparity might be due to the study setting that is tertiary hospital that mostly serves urban residence. Other possible explanation could be the difference in IDI(48).

But mobile phone ownership among pregnant women attending antenatal care in this study is higher than a study done in Kenya 74.3% (26). This might be due to the study setting which were conducted at health centers that found in rural Kenya. Mobile phone owner ship in current study is nearly similar with a study conducted in Gondar University Hospital among ART patients 76.1% (30). The possible explanation for this could be the similarity of the study area. The current study found that mobile phone ownership is much higher than the Ethiopian general mobile (SIM) population that was reported to be only 48%(27). This difference might be due to the study setting which was one of the major towns in Ethiopia. Here most of the respondents were urban residences for that they have better access to telecommunication services. Because of this, the findings of this study might not be generalizable to other areas of the country, especially in the rural communities.

According to this result the ownership of mobile is high among pregnant women attending ANC; therefore mobile phone based interventions to improve maternal health should be tried and explored further.

Findings from this study revealed that; setting alarm to take medication(15.6%) and received health related SMS from health organization or health care providers (10.7%) are higher than previous findings from Ethiopia among mobile phone users, setting alarm to take medication 8.5%and obtain SMS 8.9%(45).

It might be due to that the study period, currently network penetration is increasing in Ethiopian setup; so SMS can be reaching many mobile phone users.

But percentage of obtaining SMS for health is lower than among mobile phone users in Uganda 45.2%(45) The possible explanation could be: Uganda had many mhealth programs that could deliver health information to mobile phone users.

Ninety percent and Eighty seven percent of current mobile phone owners can read and send text message respectively. So technical feasibility from the respondent side may not be the main issue to implement SMS based mhealth.

About 71.2% of the respondents were willing to receive SMS based mhealth intervention. This is lower than studies from Argentina 96% (22), and South Africa (under option B+) 88.1% (31) and Kenya 92% (26). This discrepancy could be due to the difference in health literacy and perceived benefits of technology for health.

Among pregnant women who were willing to receive SMS 94.6% of them preferred to begin receiving message before 3 month of pregnancy, which is the ideal time to start ANC follow up (1). Three quarter of the respondents preferred to receive SMS once per week. So that it will reduce text message fatigue that could be sent frequently.

Majority of respondents were interested to receive SMS based pregnancy related information via their mobile phone; like activities or thing that should be avoid during pregnancy, diet ,pregnancy and delivery course. It might be due to health seeking behavior of the community is increasing. So pregnant women in Ethiopia could benefit from mHealth program as a result, women can get focused ANC service components which help to improve maternal health.

From those who were willing to receive SMS, about 22% of the respondents were not willing to pay for SMS on current tele tariff even though the benefit was clearly stated. An explanation for this could be that ANC service in Ethiopia are provided as free of charge by the Ethiopian government and thus mothers might not want to take up any new costs. This finding has important implications for program managers and designers, as they may need to devise alternative payment mechanisms for SMS in future intervention strategies.

This study identified some factors significantly associated with willingness to receive SMS based mhealth interventions among pregnant women. Pregnant women who were from the youth age group are more likely to be willing to receive SMS. This result is consistent with a study from Korea(39) , USA(40) and Kenya(33). This finding is also in line with a study done in Ethiopia among ART patients (30).

Our analysis indicated that women who achieved secondary or above education were more likely to be willing to receive SMS based mobile health interventions. This study is in line with a study from Ethiopia among ART patients(30), Nigeria among women willingness for child immunization(24), and USA(37). The result suggests that implementing SMS based mhealth intervention is particularly more feasible in the younger age group and more educated once. It might be a potential drawback to implementing SMS mhealth intervention program because about 22% of the respondents have not primary schooling.

This brings to glow the influence of maternal education status on ANC utilization, as confirmed by other evidence(4). It implies that before implement SMS based mhealth intervention to improve prenatal care utilization, apart from considering access to mobile phone, barriers that are related to the socioeconomic conditions of end-users (especially educational status) need to be fully explored and addressed.

This study also shows those who put their mobile phone in a place where others could access and use were 48.6% less likely willing to receive SMS mhealth interventions. It might be due to that they want to keep confidentiality of their health related information.

This study shows that place of residence, source of information for ANC, use internet via mobile phone, mobile phone type and mobile phone usage privacy variables like locking

mobile phone with password, and sharing mobile phone with others were not found to be significantly associated with willingness. It might be due to that respondents trust their family members who shared mobile phone with them keep confidentiality of their health related information. However, it has to be further explored whether this holds true or whether women are just not enough aware of privacy concerns about health related information.

7. Limitation

There are some limitations to this study. Since the study were an institution based cross sectional survey, only respondents who came for ANC visit were interviewed and not included those who were not come to the institution. Moreover, the study was done at health centers in a major town administration which could have overstated the accessibility of women to mobile phone and their willingness to receive SMS based mhealth intervention. The survey was also interviewer administered and even if we used neutral interviewers, there might be an interviewer and social desirability bias that could have made more participants to respond as being willing.

8. Conclusion

A high proportion of respondents have mobile phone access and are willing to receive SMS based mhealth intervention. Age, educational status, duration of holding mobile phone and put mobile phone in a place where others could access and use are significant factors associated to willingness.

9. Recommendations

The findings of this study have valuable policy implications for maternal health programs design and intervention planning and research issues.

MOH: Since access to mobile phone and willingness to receive SMS based mhealth is high, starting SMS based mhealth intervention may be valuable.

For the researchers

- Further study using Technology acceptance model might be important to explore associated factors of willingness.

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11. Annexes

Annex A: Information sheet

Research title: Willingness to receive short message service mhealth interventions to improve prenatal care among pregnant women attending antenatal care at health centers in Gondar town administration, northwest Ethiopia, 2017.

Introduction

This information sheet is to explain the research project that you are asked to join by group research investigators. The research team includes a final year MPH graduate student, 8 data collectors, 4 supervisor and 2 advisors from University of Gondar.

Name of Principal Investigator: Berhanu Fikadie (BSc)

Name of Advisors:

1. Dr. Binyam Tilahun(MSC,MPH,PHD)
2. Mr. Adane Nigusie (BSc, MPH)

Name of Organization: University of Gondar, College of Medicine and Health Sciences, Institute of Public Health.

Name of the Sponsor: University of Gondar

Purpose of the Research project

The main aim of the research study is Willingness to receive short message service mhealth interventions among pregnant women attending antenatal care at health centers in Gondar town administration, northwest Ethiopia, 2017. In the past, as far as my knowledge there is no study done on it. The information obtained from this study will also serve as a base line to implement mhealth application for ANC service.

Procedure

The study uses institution based cross-sectional study design using an interviewer based structured questionnaire. Permission will be obtained from the UoG, Gondar town Health department and finally from health centers in Gondar town.

Risk and/or Discomfort

There will not be risk or discomfort that study participants will face by participating in this research except devotion of time for responding the questionnaire. Every piece of information will be kept confidential**.**

Benefits

There will not be direct benefit to study participants in this research project, There will benefit for ministry of health or mhealth projects as entrance for pilot program.

Confidentiality

The information which will be collected for this research project will be kept confidential and information collected by this study will be stored in a file anonymously, instead a code number will be assigned for it and will not be realized to anyone except the principal investigator.

Right to Refusal

Respondents have the full right to refuse from participating in research and have also the full right to leave from the study at any time they wish, without losing any of their right.

Persons to contact

This research project was reviewed and approved by the ethical committee of the University of Gondar. If they want to know more information they can contact the body through the addresses stated below.

1. Mr.Berhanu Fikadie Cell Phone:0921-01-31-29
   Email: berhanufikadie@gmail.com
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   Email: binigcms@gmail.com
3. Mr. Adane Nigusie cell phone:0913673758
   Email:adane_n@yahoo

Annex B: Translated Amharic Version

የምርምሩ /የጥናቱ ርዕስ

በአማራ ክልላዊ መንግስት ጤና ጥበቃ ቢሮ በጎንደር ከተማ በሚገኙ ጤና ጣቢያ ለእርግዝና ክትትል ለመጡ እናቶች በሞባይል አጭር የጽሁፍ መልክት ቢላክ የመጠቀም ፈቃደኝነታቸዉን ለማወቅ እና ተዛመጅ ምክንያቶቻቸውን ለመለየት የታሰበ ጥናት ነው፡፡

መግቢያ

ይህ አጠር ያለ ጽሑፍ የተዘጋጀው ስለ ምርምሩ መግለጫ ለመስጠትና የሰው ኃይል ስብጥሩን ለማወቅ ታስቦ ነው፡፡ የጥናቱ ቡድን የመጨረሻ ዓመት ተማሪ የሆነውን (ዋና ተመራማሪውን)፣ 8የሰለጠኑ መረጃ ሰብሳቢ ባለሙያዎች,4 ሱፐርቫይዘር እንዲሁም 2 አማካሪዎችን (ከጎንደር ዩኒቨርሲቲ) የያዘ ነው፡፡

ዋና ተመራማሪ፡- ብርሃኑ ፍቃዴ

የአማካሪወቹ ስም፡

1. ዶ/ር ቢንያም ጥላሁን

2.አቶ አዳነ ንጉሴ

የድርጅቱ ስም፡ የጎንደር ዩኒቨርሲቲ

ስፖንሰር፡ የጎንደር ዩኒቨርሲቲ

የጅሮጀክቱ ዓላማ፡-

የዚህ ምርምር ዋና ዓላማ በአማራ ብሄራዊ ክልላዊ መንግስት ጤና ጥበቃ ቢሮ ጎንደር ከተማ ጤና መምሪያ ስር ባሉ ጤና ጣቢያዎች ለእርግዝና ክትትል ለመጡ እናቶች በሞባይ ስልክ አጭር የጽሁፍ መልክት ቢላክ የመጠቀም ፈቃደኝነታቸዉን ለማወቅ እና ተዛመጅ ምክንያቶቻቸውን ለመለየት የታሰበ ጥናት ነው፡

የአጠናን ዘዴ

ለምርመሩ የሚውለው መረጃ የሚገኘው በቀጥታ ከተሳታፊዎቹ ጋር በሚደረግ ቃለ መጠይቅ ይሆናል፡፡ የመርምሩ ፈቃድ በቅድሚያ በጎንደር ዩኒቨርሲቲ አውቅና ካገኘ በኋላ፣ ከጎንደር ጤና መምሪያ ፈቃድ ሲያገኝ የሚከናወን ይሆናል፡፡

ሊከሰቱ የሚችሉ ችግሮች

በዚህ ምርምር ውስጥ በመሳተፍዎ ጊዜወትን ከማባከንዎ በቀር ምንም አይነት የሚያጋጥምዎ ችግር አይኖርም፡፡

ከምርምሩ ሊያገኙት የሚችሉት ጥቅም

በዚህ ጥናት በመሳተፍዎ እርሰዎ በቀጥታ የሚያገኙት ጥቅም ባይኖርም በተዘዋዋሪ ማለትም ለጎንደር ከተማ እናቶች ህጻናት እንዲሁም ማህበረሰብ ጤና ጠቃሚ እንደሚሆን ይታመናል፡፡ በተጨማሪ ለጤና ጥበቃ ሚኒስቴር እና አጋር ድርጅቶች አጭር የጽሁፍ መልክት አገልግሎት ለመጀመር እንደመግቢያ ይረዳል፡፡ ስለዚህ በጥናቱ ቢሳተፉ ጠቀሜታው የጎላ ነው፡፡

ሚስጥራዊነቱ

እያንዳንዱ በጥናቱ የሚካተቱ መረጀዎች በአግባቡ እና ሚስጥራዊነቱን አንደተበቀ ስምዎትን ባልገለጸ መልኩ በተሰጠዎ ልዩ ቁጥር ይቀመጣል፡፡ ይህም ከተመራማሪው በስተቀር ለማንም ግልጽ አይሆንም፡፡

በፈቃደኝነት ላይ የተመሰረተ ስለመሆኑና ተሳትፎን ስለማቋረጥ መብት

በዚህ ምርምር ውስጥ መሳተፍ በእርሰዎ ፈቃድ ላይ የተመሰረተ ነው፡፡ እንዲሁም በምርምሩ ሂደት ላይ በማንኛውም ሰዓት የማቋረጥ መብት አለዎት፡፡

ስለምርምሩ ጥያቄ ካለዎት

ይህ ምርምር በጎንደር ዩኒቨርሲቲ የስነ ምግባር ኮሚቴ የታየ እና ፈቃድ ያገኘ ነው፡፡ ተጨማሪ መረጃ ከፈለጉ ከዚህ በታች ስማቸውና አድራሻቸው በተዘረዘሩት ሰዎች ማግኘት ይችላሉ፡፡

በመሆኑም ምርምሩን በተመለከተ ሆነ ሌሎች ጥያቄዎች ካለዎት፤

1. ብርሃኑ ፍቃዴ ስልክ፡09210-131-29/ ኢ-ሜል: berhanufikadie@gmail.com
2. ዶ/ር ቢንያም ጥላሁን ስልክ፡0913875066/ ኢ-ሜል: binigcms@gmail.com
3. አቶ አዳነ ንጉሴ ስልክ፡ 0913673758/ኢ-ሜል: adane_n@yahoo.com

Annex C: Consent form

A questionnaire prepared to assess willingness to receive SMS based mhealth intervention for ANC service among pregnant women attained ANC at health centers in Gondar town administration, North West Ethiopia, 2017.

Greetings

Dear participants!

Hello! My name is _____, I am here on behalf of Mr. Berhanu Fikadie, student of institute of public health in University of Gondar.

He is conducting a research for the partial fulfillment of second degree on "willingness to receive SMS based mhealth intervention for ANC service among pregnant women attained ANC at health centers in Gondar town administration, North West Ethiopia, 2017." He has received permission from institute of public health at University of Gondar and district health office to conduct the study.

You are kindly requested to be included in the study, which will have importance in improving maternal and child health services. The interview will take about 20 minutes. No information concerning you, as an individual will be passed to another individual or institution without your agreement. Your participation is voluntary and you have the right not to participate fully or partially. If you agree to be included in the study, I will start my questions by asking general identification points. Only honest answers would contribute the improvement the service to improve maternal and child health.

The study has approved from University of Gondar. May I continue?

☐Yes, proceed ☐No, good bye. Thank you for your cooperation!!

Having been well explained and informed of the intentions and benefits of the study, I am voluntary to participate in the study.

Respondent _____ Sign_____ Date_____

Interviewer Name_____ Sign_____ Date_____

Name of supervisor _____Sign_____ Date_____

(Signature of the interviewer certifying that respondent has given informed consent verbally)

Annex D: QUESTIONNAIRE English version

Questionnaire No _____

Health center Name _____

Interviewer's Name_____

Supervisor's Name_____

Date of interview: dd_____mm_____yyyy_____

Interview times taken: started_____ended_____

Part 1: Socio-demographic characteristics			
S.No	**Question**	**Response**	**Skip to/code**
101	How old are you?	---------years	
102	What is your religion?	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Jewish 6. Other specify	
103	Marital status	1. Single 2. Married 3. Separated 4. Divorced 5. Widowed	
104	Place of residence	1.Urban 2. Rural	
105	Educational status	1. Can't read and write 2. Read and write 3. Primary 4. Secondary 5. College and above	

106	Occupation	1. Jobless 2. Daily Laborer 3. Government employed 4. Merchant 5. Farmer 6. Driver 7. House wife 8. Student 9. Others Specify…	
107	Whom do you live with?	1. Live alone 2. With my spouse 3. With spouse and children 4. Unstable 5. Don't need to specify	
108	Number of children in the house	----------	
Part 2: Electricity and network availability			
201	Is there electricity in the house?	1. Yes 2. No	
202	Is there solar system in the house?	1. Yes 2. No	
203	Is network available in the house and around?	1. Yes 2. No	
Part 3: Access to health facility and ANC service			
301	Do you think that the health facility is distant to your home?	1.Yes 2.No	
302	How do you travel to come here for ANC	1. On foot	

	service?	2. By car 3. By animal 4. Other specify……..	
303	How much time does it take to get the health facility in your routine way of transportation (in Minutes?	----------	
304	Did you hear any information about ANC service before?	1. Yes 2. No →	Skip to Q306
305	If yes for Q304 where did you get the information? More than one answer is possible	1.Health institutions 2.Radio/TV 3.Text message 4. Relatives and friends 5.Health extension workers 6.Other specify---------	
306	Number of ANC visit for current pregnancy	1. 1st 2. 2nd 3. 3rd 4. 4th	
307	Do you have open communication with health professionals about your pregnancy status?	1.Yes 2.No	
308	Do you get appointment date for next visit?	1.Yes 2.No →	Skip to Q311
309	If your answer for Q 309; Do you agree	1. Yes	

	with the schedule of appointment date?	2. No	
310	Have you ever missed your ANC appointments?(for those who had ANC follow up before)	1.Yes 2.No →	Skip to Q313
311	If your answer for question 311 is yes, What was the reason to miss your appointment?	1. I forgot it 2. It is far to come here 3. I have no money for transport 4. I did not get permission from my employer 5. I was sick and unable to come myself 6. I was busy 7. Other specify……	
312	What mechanism you use to remember your appointment date?	1. Telling to family 2. Telling to neighbour 3. Mobile alarming 4. Calling to health facility 5. Using Appointment cards 6. Other specify	

Part 4: Pattern of mobile phone use and mobile phone ownership			
401	Do you have mobile phone currently?	1. Yes 2. No	Go to Q no 403
402	If your answer for question no 401 is no, Why don't you have a mobile phone?	1.Can't afford to buy it 2.No network coverage 3.No electricity at home 4.phone broken 5.phone stolen 6.I didn't know how to use 7. Others specify…….	Then Skip to Q 427
403	Type of mobile phone (See the mobile phone type if possible)	1. smart 2.Not smart 3. I don't know	
404	What is the Length of time having cell phone?	1. Less than 6 month 2. 6 months to < 1 year 3. 1 year to < 2 years 4. 2 years or more 5. Don't know/No response	
405	Did you use your mobile phone before?	1.Yes 2. No	Skip to Q409
406	If your answer for Q405 is yes, For what	1. Making phone call 2. Text message	

	purpose you used your mobile phone? More than one answer is possible	3. Taking pictures 4. Listen to radio 5. Play games 6. Other specify…..	
407	Did you use this mobile phone as your health communication means before?	1. Yes 2. No	Skip to Q 409
408	If yes for Q407 for what purpose? More than one answer is possible	1.Setting alarm for medical appointment 2. Setting alarm for taking medicine 3. Obtaining SMS reminder from clinic or doctor 4. To consult health professional 5. To browse the internet to get health related data 6. Other specify	
409	How often do you have your mobile phone with you?	1. Always 2. Sometimes 3. Seldom 4. Never	
410	Have you Changed your mobile phone number in the last 12 months?	1. Yes 2. No	Skip to Q412
411	If your answer for Q410 is yes how many times?	1. 1 time 2. 2 times 3. 3 times 4. 4 or more times	

412	Do you have any other phone number?	1. Yes 2. No →	Skip to Q414
413	If your answer is yes for question 414 how many phone numbers do you have?	1.One 2.Two 3. Three 4. More than 3	
414	Did you Switch off mobile phone during the day?	1. Yes 2. No	
415	Is there a time or place where no calls are taken?	1. Yes 2. No	
416	Are there times that you don't answer unknown calls?	1. Yes 2. No	
417	Do you use pass words to lock your mobile phone?	1. Yes 2. No	
418	Do you put your mobile phone in a place where others could use and access?	1. Yes 2. No	
419	Do you share your mobile phone to other person in the family?	1. Yes 2. No →	Skip to Q421
420	If your answer for Q419 is yes with whom?	1.Housband 2.Child/children 3. Other specify	
421	Can you send text message using your mobile?	1. Yes 2. No	
422	Can you read text message using your mobile phone?	1.Yes 2. No →	Skip to

			Q424
423	If your answer for question 422 is yes, do you delete text message without reading it?	1. Yes 2. No	
424	How likely is that a text message received on your mobile phone to be seen by others?	1. Very likely 2. Somewhat likely 3. Somewhat unlikely 4. Very unlikely	
425	Do you use internet on your mobile phone?	1. Yes 2. No	Skip to Q427
426	If your answer for Q427 is yes, for what purpose that you frequently use?(More than one answer is possible)	1. For chatting with friends and families 2. For Email 3. For browsing health information 4. For entertainment (game) 5. Others specify..	
427	Is there anyone who has mobile phone with in the family other than you?	1.Yes 2.No	

Part 5: SCENARIO ABOUT SMS BAESD MHEALTH

Introduction

Getting antenatal care service is crucial for both the health of the mother and fetus. However, many pregnant women did not get this vital health care service due to

various reasons, such as lack of awareness about the service, lack of health care provider, lack of transportation access, and lack of money for transportation to health facility, forgetting appointment date and etc. As a result the health of the mother and the fetus is in danger. Also missed appointments are a waste of money and make the health service less efficient, due to longer waiting times.

To overcome these problems the Federal Democratic republic of Ethiopia, Ministry of health planned to implement mhealth initiatives to improve maternal and child health. Short message service is one of the modalities to deliver the service. Short message service mhealth intervention is the delivery of health related information as well as health education via text message by health care provider or health facility to the receiver. It can be used for health education, reporting drug compliance, setting alarm for taking medication, appointment reminders from clinic and seek advice from health professionals

Benefits of SMS

Reduce cost and time : Limited the need to travel

Better client /Doctor Communication: client can communicate with their doctors through text, freeing up appointments.

Information: Helps to exchange information anytime the need arose and helps to send messages anywhere there is network coverage related to your health.

Alerts and Updates: Healthcare providers also use SMS to keep client updated about their appointment times and health tips.

Reduced Missed Appointments: It reminds your clinic appointment date.

Reminders: It helps to remind the time to take medication.

Part 6: Willingness to receive health information via SMS by mobile phone			
601	Based on the above scenario are you willing to receive SMS based mhealth intervention via mobile phone?	1. Yes **2.** No	Go>>>to Q603
602	If your answer for Q601 is No; what do you think is bad to receive SMS?	1. It ruins my privacy 2. Text message from one's healthcare provider would be annoying 3. It will be very difficult to operate 4. It is not important 5. Other specify	Stop here
603	If your answer for Q601 Yes, What will be the preferred time to begin SMS during pregnancy?	1. From month 1 2. From month 3 3. From month 6 4. From month 9(before birth) 5. Don't know/No response 6. other	
604	What will be the Preferred time of the day for receiving SMS?	1.Morning(8am-befre 12pm) 2.Afternoon(12 pm - before 4 pm) 3. Evening (4 pm - before 8 pm) 4.Any time 5. Don't know/No response	
605	What will be the preferred frequency to	1. 1 per week 2. 3 per week	

	receive SMS?	3. 5 per week 4. 7 per week	
606	Will you pay for text message service you send to your clinic to remind your medication and appointments according to the current telecommunication tariffs?	1. Yes 2. No	
607	If we were going to develop an application for ANC using mobile phones, what sort of pregnancy related information you preferred to receive? More than one answer is possible	1. Activities/things to avoid 2. When to call a doctor 3. Diet 4. Appointment reminders 5. What to expect at various stages of pregnancy 6. Physical activity 7. Pregnancy & delivery courses 8. Others	

Thank you for your cooperation.

Annex E: Translated Amharic version consent form

ስለጥናቱ መረጃና መጠይቅ

መግቢያ

ስሜ---------- ይባላል፡፡ በአሁኑ ሰዓት በጎንደር ኒቨርሲቲ የድህረ ምረቃ ተማሪ ከሆነው ብርሃኑ ፍቃዴ ጋር አብሬ እሰራለሁ፡፡

የጥናቱ ዋና አላማ በአሁኑ ወቅት በጎንደር ከተማ ባሉ ጤና ጣቢያዎች የቅደመ ወሊድ ክትትል የሚያደርጉ ነፍሰ ጡር እናቶች በሞባይላቸው አማካኝነት በአጭር የጽሁፍ መልዕክት የጤና መረጃ ለመቀበል ፈቃደኛ መሆናቸውን እና ፈቃደኛ እንዳይሆኑ የሚያደርጉ ምክኒያቶችን ለማወቅ ነው፡፡እርስዎ የዚህ ጥናት ተሳታፊ ይሆኑ ዘንድ ተመርጠዋል፡፡ምንም እንኳን ይህ ጥናት የተደረገው የድህረ ምረቃ ሂደቱን ለሚሟላት ቢሆንም ነገር ግን የዚህ ጥናት ጥቅም ከዚህ በላይ እንደሆነ ይታመናል፡፡ይህም አሁን ነፍሰ ጡር እናቶች ያለውን የሞባይል ባለቤትነት ሁኔታ ለማወቅና ለጤና አገልግሎት ለማዋል ፈቃደኛ መሆናቸውን ለማወቅ ፤እንዲሁም ላለመጠቀም ምክኒያት የሚሆኑ መንስኤዎችን ለመለየት ያገለግላል፡፡ይህም በሞባይላቸው አማካኝነት የሚሰሩ የተለያዩ አፕሊኬሽኖችን ለመስራትና ለጤና አገልግሎት ለማዋል ይጠቅማል፡፡ይህ ደግሞ የተሻሻለ የጤና አገልግሎት እንዲኖር ያደርጋል፡፡

ይህ መጠይቅ ደግሞ ጥናቱን ለማከናነውን ጠቃሚ ስለሆነ እንዲሞሉ በትህትና ይጠየቃሉ፤ ስለሆነም ስምዎ በመጠይቁ አይፃፍም፣ የሚሰጡትም መልስ ደግሞ ሙለ በሙሉ ሚስጥራዊነቱ ተጠብቆ ለጥናቱ ዓላማ ብቻ የሚውል ነው፡፡ ስለዚህ በሂደቱ ላይ እንዳስፈላጊነቱ በነፃነት ይናገሩ ምንም ነገር ሊያሰጋዎት አይገባም በተጨማሪም እርሰዎ መመለስ የማይፈልጉትን ጥያቄ እንዲመልሱ አይገደዱም፡፡ ለቃለ-ምልልሱ 20 ደቂቃ በቂ ሲሆን ምንም አይነት አስተያየት እና ጥያቄ ቢኖርዎት የተሰጠውን አድራሻ በመጠቀም መልስ ሊያገኙ ይችላሉ፡፡

በጥናቱ ለመሳተፍ ፈቃደኛ ነዎት?

አዎን ☐ አይደለሁም ☐ አመሰግናለሁ ደና ይሁኑ።

የጥናቱን አላማና ጥቅም በደንብ ተገንዝቤ እና አውቄ በዚህ ጥናት ለማሳተፍ ወስኛለሁ፡፡

የተሳታፊ ፊርማ ቀን

---------- ----------

የቃለ መጠይቁ ጠያቂ ስም----------ፊርማ----------ቀን--------

የተቆጣጣሪው ስም----------ፊርማ----------ቀን---------

(Signature of the interviewer certifying that respondent has given informed consent verbally)

Annex F: Amharic version translated questionnaire

የቃለ መጠይቅ መለያ ቁጥር----------

የጤና ድርጅቱ ስም----------

የቃለ መጠይቁ ጠያቂ ስም----------ፊርማ----------

የተቆጣጣሪው ስም----------ፊርማ----------

ቃለ መጠይቁ የተደረገበት ቀን--------ወር-------ዓ.ም-------

ቃለ መጠይቁ የወሰደዉ ጊዜ----------

መመሪያ፡ ከዚህ በታች ላሉት ጥያቄዎች መልስ የሚሉትን ይምረጡ (ይናገሩ)፡፡ (ከአንድ በላይ መልስ ይኖረዋል የመሚሉት ሲኖር መመረጥ ይችላሉ)

ክፍል አንድ፡ ማህበራዊና ስነ-ህዝብ ሁኔታን የሚዳስሱ ጥያቄዎች			
	ጥያቄ	ምላሽ	ይለፉ
101	በአሁኑ ሰዓት እድሜዎ ስንት ነዉ?	-------- አመት	
102	ኃይማኖት	1.ኦርቶዶክስ 2.ሙስሊም 3.ፕሮቴስታንት 4.ቤተ እስራኤል 5. ካቶሊክ 6. ሌላ ካለ ይጥቀሱ.....	
103	መኖሪያ ቦታ	1.ከተማ 2.ገጠር	
104	የጋብቻ ሁኔታ	1.ያላገባች 2.ያገባች 3.የፈታች 4.የሞተባት 5. ተለያይታ የምትኖር	
105	የትምህርት ደረጃ	1. ማንበብና መጻፍ የማይችል 2. ማንበብና መጻፍ የሚችል 3. አንደኛ ደረጃ	

		4. ሁለተኛ ደረጃ 5. ኮሌጅና ከዚያ በላይ	
106	ሥራ	1. ሥራ ፈላጊ 2. የቀን ሰራተኛ 3. የመንግስት ሰራተኛ 4. ነጋዴ 5. ገበሬ 6. ሹፌር 7. የቤት እመቤት 8. ተማሪ 9. ሌላ /ይጥቀሱ.....	
107	ከማን ጋር ነው ሚኖሩት?	1.ብቻየን 2.ከባለቤቴ ጋር ብቻ 3. ከባለቤቴ እና ልጆቸ ጋር 4. አንድ ቦታ ተረጋግቸ አልኖርም 5. ሌላ ካለ ይጥቀሱ...	
108	ቤት ዉስጥ ስንት ልጆች አለወት?	----------	
ክፍል 2፡ኤሌክትሪክ እና ኔትወርክ አቅርቦት			
201	ቤተዎ ዉስጥ ኤሌክትሪክ አለ?	1. አዎ 2. የለም	
202	ቤተዎ ዉስጥ በፀሀይ የሚሰራ የሀይል አማራጭአለ?	1. አዎ 2. የለም	
203	ቤተዎ ዉስጥ እና አካባቢዎ ኔትወርክ/አዉታር አለ?	1. አዎ 2. ለም	

ክፍል 3፡የጤና አገለግሎት ተደራሽነት እና ቅድመ ወሊድ አገልግሎትነ በተመለከተ			
301		1. አዎ	

	አቅራቢያዎ ያለዉ ጤና ድርጅት ከመኖሪያ ቤተዎ እሩቅ ነው ብለዉ ያስባሉ?	2. አይ	
302	ለቅድመ ወሊድ አገልግሎት ወደ ጤና ድርጅቱ የመጡት በምንድን ነዉ ?	1. በእግር 2. በመኪና/ባጃጅ 3.በፈረስ/በቅሎ 4. ሌላ ካለ ይጥቀሱ	
303	አዘውተረው በሚጠቀሙበት የትራንስፖረት አማራጭ ተጠቅመው እዚህ ለመድረስ ምን ያክል ደቂቃ ይፈጅብዎታል?	----------	
304	ስለ ለቅድመ ወሊድ አገልግሎት ከአሁን በፊት ሰምተዉ ያዉቃሉ?	1.አዎ 2.አይ →	ወደ ጥያቄ ቁጥር 306 ይለፉ
305	ለጥያቄ ቁጥር 304 መልሰዎ አዎ ከሆነ መርጃዉን ያገኙት የት ነበር? (ከአንድ በላይ መልስ ይቻላል)	1. ከጤና ድርጅት 2. ከራዲዮ/ቴሌቪዥን 3. ከአጭር የጽሁፍ መልክት 4. ከቤተሰብ ወይም ዘመድ 5.ከጤና ኤክስቴንሽን ባለሙያ 6. ሌላ ካለ ይጥቀሱ	
306	ለአሁኑ እርግዝና ይህ የቅድመ ወሊድ አገልግሎት ለስንተኛ ጊዜ ነዉ?	1.ለመጀመሪያ 2.ለሁለተኛ 3.ለሦስተኛ 4.ለአራተኛ	
307	ስለ እርግዝናዉ ከጤና ባለሙያዉ ጋር ግልጽ የሆነ ዉይይት አድርገዋል?	1.አዎ 2.የለም	
308	የቀጠሮ ጊዜ ተሰቶወታል?	1.አዎ 2. የለም →	ወደ ጥያቄ ቁጥር 311 ይለፉ
309	ለጥያቄ ቁጥር 309 መልሰዎ አዎ ከሆነ በቀጠሮዉ ቀን ደስተኛ ነወት?	1.አዎ 2.አይ	
310	የቀጠሮ ቀን አሳልፈዉ ያዉቃሉ(ከአሁነ በፊት ክትትል ለነበራቸዉ)?	1.አዎ 2.የለም →	ወደ ጥያቄ ቁጥር 313

			ይለፉ
311	ለጥያቄ ቁጥር 311 መልስዎ አዎ ከሆነ የቀጠሮ ጊዜዎን ያሳለፉበት ምክንያት ምን ነበር?	1. ረስቸው ነበር 2. እሩቅ ስለሆነብኝ 3.ለትራንስፖረትብር ስላልነበረኝ 4. ከመስረያ ቤት ፈቃድ ስላላገኘሁ 5. አሞኝ ስለነበር 6. ስራ ስለነበረኝ 7. ሌላ ካለ የጥቀሱ.....	
312	የቀጠሮ ቀነዎትን ለማስታወስ የሚጠቀሙበት ዘዴ ምንድን ነዉ?	1. ለቤተሰብ በመንገር 2. ለጎረቤት በመንገር 3. በሞባይል አላርም በመሙላት 4.ወደ ጤና ተቋመ በመደወል 5. በቀጠሮዉ ካርድ 6. ሌላ ካለ ይጥቀሱ...	

ክፍል 4፡ የሞባይል ስልክ ባለቤትነት እና የአጠቃቀም ሁኔታ			
401	የሞባይል ስልክ አለዎት ?	1. አዎ 2. አይ	ወደ ጥያቄ ቁጥር 403 ይለፉ
402	ለጥያቄ ቁጥር 401 መልስዎ አይ ከሆነ የሞባይል ስልክ የሌለዎት ለምንድነ ነዉ?	1. የመግዛት አቅም ስለሌለኝ 2.የሞባይል አገልግሎት (ኔትወርክ) ስለሌለ 3. ኤሌክትሪክ ቤት ዉስጥ ስለሌለ 4. የሞባይልቀፎው ተሰብሮብኝ 5. የሞባይልቀፎው ተሰርቆብኝ 6. አጠቃቀሙን ስለማልችልበት 7. ሌላ ካለ ይጥቀሱ....	ወደ ጥያቄ ቁጥር 427 ይለፉ
403	ለጥያቄ ቁጥር 401 መልስዎ አዎ ከሆነ ምን አይነት ነው?	1. ስማርት	

	(ስልኩን ይመልከቱ)	2. ስማርት ያልሆነ 3. አላዉቀዉም	
404	የሞባይል ስልክ ባለቤት ከሆኑ ምንያክል ጊዜ ሆነዎት?	ነ.ከ6 ወር ያነሰ 2.ከ6ወር-ነዓመት 3.ከነዓመት-2ዓመት 4. 2ዓመትእና ከዚያበላይ 5. አላስታዉስም	
405	ከአሁን በፊት የሞባይል ስልክዎን ተጠቅመዉበት ያዉቃሉ?	ነ.አዎ 2.አይ	ወደ ጥያቄ ቁጥር 409ይለፉ
406	ለጥያቄ ቁጥር 405 መልስዎ አዎ ከሆነ ለምን አገልግሎት ይጠቀሙበታል? (ከአንድ በላይ መልስ መምረጥ ይቻላል)	ነ.ስልክ ለመደወል 2. መልዕክት ለመላክ 3.ፎቶ ለማንሳት 4.ሬዲዮ ለማዳመጥ 5.ጨዋታ ለመጫወት 6.ሌላ ካለ ይጥቀሱ…	
407	የሞባይል ስልክዎን ለጤና መረጃ አገልግሎት ተጠቅመዉበት ያዉቃሉ?	ነ.አዎ 2.አይ	ወደ ጥያቄ ቁጥር 409ይለፉ
408	ለጥያቄ ቁጥር 407 መልስዎ አዎ ከሆነ ለምን አገልግሎት ተጠቀሙበታል?(ከአንድ በላይ መልስ መምረጥ ይቻላል)	ነ. ለህክምና ቀጠሮ ማስታወሻ 2. መድሃኒት ለመዉሰድ ማንቂያ 3. ከጤና ተቋም ወይም ጤና ባለሙያ ጤና ነክ መረጃዎችን በአጭር የጽሁፍ መልዕክት ለመቀበል 4.በሞባይል ስልክ የጤና ባለሙያ ለማማከር 5. በበይነ መረብ/ኢንተርኔት ጤና ነክ መረጃዎችን ለማገኘት 6. ሌላ ካለ ይጥቀሱ…	
409	የሞባይል ስልክዎ ምን ያህል ጊዜ እርስዎ ጋር ይሆናል?	ነ. ሁልጊዜ 2. አንዳንድ ጊዜ 3. በጣም አልፎ አልፎ 4. ምንም አልይዝም	
410	በዚህ ዓመት ዉስጥ የስልክ ቁጥር ቀይረዋል?	ነ. አዎ 2. የለም	ወደ ጥያቄ ቁጥር 412ይለፉ

411	ለጥያቄ ቁጥር 410 መልስዎ አዎ ከሆነ ስንት ጊዜ ?	1. አንድ ጊዜ 2. ሁለት ጊዜ 3. ሦስት ጊዜ 4. አራት ጊዜ እና ከዚያ በላይ	
412	አሁን ከሚጠቀሙበት ውጭ ሌላ የሚጠቀሙበት ስልክ ቁጥር አለ?	1. አዎ 2. አይ →	ወደ ጥያቄ ቁጥር 414ይለፉ
413	ለጥያቄ ቁጥር 412 መልስዎ አዎ ከሆነ ስንት?	1. አንድ 2. ሁለት 3. ሦስት 4. አራት	
414	የሞባይል ስልክዎትን ቀን ላይ ጥሪ እንዳይቀበል ያደርጋሉ?	1.አዎ 2. አይ	
415	አንዳንድ ጊዜ ወይም ቦታ ስልክ የማያነሱበት ሁኔታ አለ ?	1.አዎ 2.የለም	
416	በማያውቁት ስልክ ቁጥር ወደ ስልክዎት ሲደዎል የማያነሱበት ሁኔታ አለ?	1.አዎ 2.የለም	
417	ሥልክዎትን በፓሰዎርድ (የይለፍቃል) ይቆልፋሉ?	1.አዎ 2. አይ	
418	የሞባይል ስልክዎትን ሌሎች ሊያገኙትና ሊጠቀሙበት የሚችሉበት ቦታ ያሰቀምጣሉ?	1.አዎ 2.አይ	
419	የሞባይል ስልክዎን ለቤተሰብ አባላት ያጋራሉ?	1.አዎ 2.አይ →	ወደ ጥያቄ ቁጥር 421 ይለፉ
420	ለጥያቄ ቁጥር 419 መልስዎ አዎ ከሆነ ለማን?	1.ለባለቤቴ 2.ለልጀ/ጆች 3.ሌላ ካለ ይጥቀሱ...	
421	የሞባይል ስልክ በመጠቀም የጽሁፍ መልዕክት መላክ ይችላሉ?	1.አዎ 2.አይ	
422	የሞባይል ስልክ በመጠቀም የጽሁፍ መልዕክት ማንበብ ይችላሉ?	1.አዎ 2.አይ →	ወደ ጥያቄ ቁጥር 424 ይለፉ
423	ለጥያቄ ቁጥር 422 መልስዎ አዎ ከሆነ የተላከልዎትን የጽሁፍ መልዕክት ሳያነቡ ያጠፋሉ?	1.አዎ 2.አይ	
424	የተቀበሉት የጽሁፍ መልዕክት በሌሎች ሰዎች የመታየት ዕድሉ ምን ያህል ነው ይላሉ ?	1.በጣም ከፍተኛ 2.ከፍተኛ 3.ዝቅተኛ 4.በጣም ዝቅተኛ	

425	የሞባይል ስልክዎን የኢንተርኔት አገልግሎት ይጠቀሙበታል ?	ነ.አዎ 2አይ	ወደ ጥያቄ ቁጥር 427ይለፉ
426	ለጥያቄ ቁጥር 426 መልስዎ አዎ ከሆነ በአብዛኛዉ የሚጠቀሙት ለምንድነ ነው? (ከአንድ በላይ መልስ መምረጥ ይቻላል)	ነ. ከጓደኛ/ቤተሰብ ጋር ለማዉራት 2. መረጃ ለመላላክ 3. የጤና መረጃ ለመፈለግ 4. ለመዝናኛ/ጨዋታ 5. ሌላ ካለ ይጥቀሱ…	
427	ከእርሰዎ ዉጭ ቤት ዉስጥ ካሉ የቤተሰብ አባላት የሞባይል ስልክ ያለዉ አለ?	ነ.አዎ 2. የለም	

ክፍል 5፡ ስለ አጭር የጽሁፍ መልእክት ሀሳባዊ ገለፃ

መግቢያ

የቅድመ ወሊድ እንክብካቤ አገልግሎት ማግኘት ለእናትየዋም ሆነ ለጽንሱ ጤንነት ወሳኝ ነው:: ይሁን እንጂ, ብዙ ነፍሰ ጡር እናቶች በተለያዩ ምክንያቶች ለምሳሌ፡- የቀጠሮ ቀን በመርሳት፣ስለ አገልግሎቱ ግንዛቤ በማጣት፣ የጤና ባለሙያ እጥረት,፤ የትራንስፖርት ተደራሽነት ማነስ እና ወደ ጤና ተቋም የመጓጓዣ ገንዘብ በማጣት ይህን አስፈላጊ የጤና እንክብካቤ አገልግሎት ሳያገኙ ይቀራሉ፡፡ በዚህ ምክንያት የብዙ እናቶች ጤንነት እና ጽንስ አደጋ ላይ ይወድቃል፡፡ ለከፋ የጤና ችግርም ይጋለጣሉ፡፡

እነዚህን ችግሮች ለመፍታት በኢትዮጵያ ፌዴራላዊ ዲሞክራሲያዊ ሪፑብሊክ የጤና ጥበቃ ሚኒስቴር የእናቶችን ጤና ለማሻሻል የሞባይል ስልክ በመጠቀም የጤና አገልግሎት ተደራሽነትን ተግባራዊ ለማድረግ አቅዷል፡፡ይህን ለመተግበር ጤና ነክ መረጃዎችን በአጭር መልዕክት አገልግሎት መላክ አንዱ አማራጭ ነው፡፡ አጭር መልዕክት አገልግሎት ማለት የሞባይል ስልክ በመጠቀም መረጃን በጥሪ ወይም በጽሑፍ ማስተላለፍ ማለት ነው፡፡

የአጭር የጽሁፍ መለዕክት ጥቅሞች

ወጭ: - የጤና ተቋም ለማግኘት የትራንስፖርት ወጪ ይቀንሳል

ጊዜ:-ወደ ጤና ድርጅት ሳይሄዱ ቤት እያሉ የጤና ባለሙያ ማማከርይ ችላሉ፡፡

መረጃ:- ወቅታዊ የጤና መረጃዎን ለማግኘት ይረዳል፣በማንኛውም ጊዜ የጤና እንክብካቤ አገልግሎት ለማገኘት ይረዳል፣ በእርግዝና ወቅት ጤናዎን እንዴት መንከባከብ እነዳለበዎት ምክር ያገኛሉ,.

ለማስታወስ፡- የቀጠሮ ቀን እና መድሃኒት መውሰጃ ሰዓትን ያስታውሰናል፡፡

ክፍል 6:በአጭር የጽሁፍ መልዕክት ጤና መረጃ ለማገኘት ፈቃደኝነት

601	ከላይ በተደረገዉ ገለፃ መሰረት በሞባይል ስልክ ኣማካኝነት አጭር መልክት ተልኮልዎት ስለ እርግዝናዎ እና ሌሎች የጤና መረጃዎች እንዲያገኙ ቢደረግ ፈቃደኛ ነወት?	1.አዎ ፈቃደኛ ነኝ 2.አይደለሁም	ወደ ጥያቄ ቁጥር 603ይ ለፉ
602	ለጥያቄ ቁጥር 601 መልስዎ አይደለሁም ከሆነ ምክንያቱ ምንድን ነዉ?	1.ሚስጢር ያወጣል 2. መልክቱ ይረብሸኛል 3. ማነበብ ስለማልችል 4. ስለማይጠቅም 5. ሌላ ካለ ይጥቀሱ…	ከዚህ ላይ አቁም
603	በእርግዝና ወቅት ከመቸ ጀምሮ መልዕክት ቢላክ ይመርጣሉ?	1. ከ 1 ወር ጀምሮ 2. ከ 3 ወር ጀምሮ 3.ከ 6 ወር ጀምሮ 4.ከ 9 ወር ጀምሮ(ከወሊድ በፊት) 5. መልስ አልተሰጠም	
604	አጭር የጽሁፍ መልዕክት በምን ሰዓት ቢላክ ይመርጣሉ?	1. ጠዋት ከ2 እስከ ቀኑ 6 ሰዓት 2. ከቀኑ 6-10 ሰዓት 3. ከ ቀኑ 10 እስከ ምሽቱ 4 ሰዓት 4. በማንኛዉም ሰዓት 5. መልስ አልተሰተም	
605	አጭር የጽሁፍ መልዕክ በየስንት ጊዜ ቢላክ ይመርጣሉ?	1. በሣምንት አንድ ጊዜ 2. በሣምንት ሦስት ጊዜ 3. በሣምንት አምስት ጊዜ 4. በሣምንት ሰባት ጊዜ 5. ሌላ ካለ ይጥቀሱ…	
606	የቀጠሮ ጊዜዎትን ለማስታወስ እና የጤና መረጃ ለመጠየቅ ቢፈለጉ የህክምና አገለግሎት ወደሚያገኙበት ተቁዋም የሞባይል መልእክት ልከው አገልግሎት ቢያገኙ ወይም ቢደዉሉ የወቅቱን የቴሌ ታሪፍ መሰረት ያደረገ ክፍያ ይከፍላሉ?	1.አዎ 2. አይ	
607	እኛ በሞባይል አማካኝነት የሚሰራ ለቅድመ ወሊድ አገልግሎት የሚሆን መተግበሪያ ወይም አፕሊኬሽን ብንሰራ በአጭር የጽሁፍ	1. በእርግዝና ወቅት መደረግ ሰለሌለባቸዉ ነገሮች	

	መልዕክት እንዲላክለዎት የሚፈልጉት መረጃ ምንድን ነዉ? (ከአንድ በላይ መልስ መምረጥ ይቻላል)	2. ለጤና ባለሙያ መቸ መደወል እንዳለብኝ 3. ስለ አመጋገብ 4. የቀጠሮ ቀን ማስታወሻ 5. በተለያየ የእርግዝና ደረጃ ስለሚከሰቱ ሁኔታወች 6. ስለ አካላዊ እንቅስቃሴ 7. ስለ ወሊድ 8. ሌላ ካለ ይጥቀሱ…	

ቃለ መጠይቃችን ጨርሰናል ጊዜዎን ሰውተው ስላደረጉልን ቀና ትብብርዎ ከልብ እናመሰግናለን፡፡

Annex G: Declaration Sheet

I, the undersigned, MPH student declare that this thesis work is my original work in partial fulfillment of the requirement for the degree of Master of Public Health in Health Informatics.

Name of Student: Berhanu Fikadie (BSc)

Date:_____ Signature: _____

Place of submission: Institute of Public Health, College of Medicine and Health Sciences, University of Gondar.

Date of submission: _____

This thesis work has been submitted with my/our approval as university advisor(s)

Advisors

Name	Signature	Date
1. Dr.Binyam Tilahun (PhD)	_____	_____
2. Mr. Adane Nigusie (MPH)	_____	_____

College of Medicine and Health Sciences

Institute of Public Health

Annex H: Approval Sheet

This is to certify that the thesis entitled with “Willingness to receive short message service mhealth interventions to improve prenatal care among pregnant women attending antenatal care at health centers in Gondar town administration, Northwest Ethiopia, 2017” submitted by Berhanu Fikadie for the award of MPH degree in Health Informatics was carried out under our supervision and the thesis has not been previously submitted in part or full for any degree or diploma for this or any university.

Advisors

Name	Signature	Date
1. Dr.Binyam Tilahun (PhD)	_____	_____
2. Mr.Adane Nigusie (MPH)	_____	_____